UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

APR 5 2001

In Reply Refer To:
SWR-00-SA-289:MEA

Michael Finan
Chief, Delta Office
U.S. Army Corps of Engineers
Regulatory Branch
1325 J Street
Sacramento, California 95814-2922

Dear Mr. Finan:

Enclosed is a final biological opinion prepared by the National Marine Fisheries Service (NMFS) on the proposed Army Corps of Engineers (ACOE) permit (200000696) to the California Department of Water Resources (DWR) for the south Delta Temporary Barriers Project, located in the south Sacramento-San Joaquin River Delta, San Joaquin County, California,, and its effects on federally endangered Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*), and threatened Central Valley steelhead (*Oncorhynchus mykiss*) pursuant to Section 7 of the Endangered Species Act of 1973, as amended (Act). Consultation was formally initiated by ACOE on December 4, 2000. This biological opinion is based on information provided with the ACOE initiation letter and through a number of consultation meetings with DWR staff.

Based on the best available scientific information, this biological opinion concludes that the proposed south Delta Temporary Barriers Project is not likely to jeopardize the continued existence of Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, or Central Valley steelhead, or result in the destruction or adverse modification of designated critical habitat for these species. An incidental take statement with reasonable and prudent measures designed to minimize incidental take has been prepared and is included in the biological opinion. The incidental take statement anticipates the incidental take of Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, and Central Valley steelhead during the course construction and operation of the south Delta Temporary Barriers Project, as described in this biological opinion.

Consultation must be reinitiated if (1) the amount or extent of incidental take specified in the incidental take statement is exceeded; (2) new information reveals that the south Delta Temporary Barriers Project may affect Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, or Central Valley steelhead in a manner or to an extent not

considered in the biological opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species that was not considered in the biological opinion; or (4) a new species is listed, or critical habitat is designated that may be affected by the south Delta Temporary Barriers Project.

If you have questions concerning this opinion, or need further assistance, please contact Mr. Michael Aceituno, Supervisor, Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814. Mr. Aceituno can be reached by telephone at (916) 930-3600 or by FAX at (916)930-3629.

Sincerely,

Rodney R McInnis

for Rebecca Lent, Ph.D.
Regional Administrator

Enclosure

cc: Kathy Kelly, DWR, Sacramento, CA

BIOLOGICAL OPINION

Agency: U. S. Army Corps of Engineers, Sacramento District

Activity: Issuance of Permit Extension (No. 200000696) for the Department of Water Resources Temporary Barrier Project

Consultation Conducted By: Southwest Region, National Marine Fisheries Service

Date Issued: APR 15 2001

I. INTRODUCTION AND CONSULTATION HISTORY

This document transmits the National Marine Fisheries Service (NMFS) biological opinion on the proposed Army Corps of Engineers (ACOE) permit to the California Department of Water Resources (DWR) for the Temporary Barriers Project, located in the south Sacramento-San Joaquin River Delta (south Delta), San Joaquin County, California, and its effects on federally listed threatened Central Valley steelhead (*Oncorhynchus mykiss*), endangered Sacramento River winter-run (*O. tschawytscha*), Central Valley spring-run (*O. tschawytscha*) and the candidate Central Valley fall and late fall-run chinook salmon (*O. tschawytscha*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Consultation was formally initiated by ACOE on December 4, 2000.

Informal consultation began in early November 2000 between the DWR and NMFS when the proposed Temporary Barriers Project (TBP) was introduced at the CALFED South Delta Improvement Team (SDIT) meeting. The SDIT is composed of CALFED staff as well as California Department of Fish and Game (DFG), U.S. Fish and Wildlife Service (USFWS), U.S. Bureau of Reclamation (USBR) , ACOE, NMFS, and DWR staff. Consultation with the DFG and the USFWS proceeded concurrently with the NMFS consultation.

On November 16, 2000, DWR submitted the Temporary Barrier Project Permit Extension Application Number 200000696 to the ACOE for a permit under Section 404 of the Clean Water Act and Section 10 of the River and Harbors Act. On November 16, 2000 informal consultation continued at the SDIT meeting. On November 21, 2000, DWR, in compliance with the California Environmental Quality Act (CEQA), submitted an Initial Study and Proposed Mitigated Negative Declaration to the Governor's Office of Planning and Research or the State Clearinghouse for public review. On November 20, 2000 informal consultation continued at the SDIT meeting.

The ACOE initiated formal consultation with the USFWS and NMFS on December 4, 2000 by requesting a Biological Opinion from the agencies by April 12, 2001. On December 19, 2000, the first formal TBP consultation meeting, separate from the SDIT, was held between DWR, USBR,

DFG, NMFS, USFWS, CALFED staff and a representative of the South Delta Water Agency (SDWA). The topics of discussion included the DWR proposal for early installation of the barriers in March and timing of the installation of each of the barriers under various situations. Subsequent consultation meetings were held on January 5,17, 25, February 5, 15 and March 1, 2001. Through these meetings, an Adaptive Management Plan was developed for the timing of installation and operation of the barriers alone and in combination with one another. Contingencies were developed based on water year, low water stages, exports, the Vernalis Adaptive Management Program operations, and various biological indicators. Mitigation and avoidance measures and monitoring plans were also developed during the meetings.

II. DESCRIPTION OF THE PROPOSED ACTION

The Temporary Barriers Project is a proposal to install up to three rock flow control structures and one rock flow and fish control structure in south Delta channels at various times during a seven-year period (2001-2007), or until permanent flow control structures are constructed. These temporary rock barriers are proposed to be placed at the following locations:

1. Old River near Tracy: in Old River about 0.5 mile east of the Delta-Mendota intake;

2. Middle River near Victoria Canal: in Middle River about 0.5 mile south of the confluence of Middle River, Trapper Slough, and North Canal;

3. Old River near San Joaquin River: in Old River within 0.1 mile west of the San Joaquin River confluence; and,

4. Grant Line Canal near Tracy Road Boulevard Bridge: in Grant Line Canal, 420 feet east of the bridge.

Three of the rock barriers, Old River near Tracy, Middle River, and Grant Line Canal, are tidal barriers that are designed to improve water levels and circulation for local South Delta farmers. The fourth barrier, the Head of Old River barrier (HORB), is designed to improve migration conditions in the South Delta for salmon migrating in the San Joaquin River during the spring and fall.

The water level in Old and Middle rivers and Grant Line Canal, downstream of the confluence of the San Joaquin River and Old River, is reduced when the HORB is in place. This is because the barrier restricts flows from the San Joaquin River into Old River. To mitigate for the restricted flows and reduced water levels downstream of the HORB, the Middle River and Old River near Tracy barriers will be installed when the HORB is in place. This project proposes that the Grant Line Canal barrier (with the culverts tied open) also be installed when the HORB is installed. The proposal to install the spring HORB and the consequent agricultural impacts and need to mitigate for the HORB were acknowledged in the Central Valley Project Improvement Act

(CVPIA).

The HORB is installed twice each year, once in the spring and again in the fall. The spring HORB is normally installed from April 15 to May 15. The fall HORB is generally operated between September 15 and November 30, when requested by DFG. DWR received a 1601 Streambed Alteration Agreement from Department of Fish and Game for the spring and fall HORB installation. This agreement expires in 2005.

Beginning in 1992, DFG requested that DWR install a spring barrier facility at the head of Old River. The spring HORB is designed to reduce the loss of outmigrating San Joaquin fall-run chinook salmon smolts by significantly decreasing their diversions down Old River, consequently reducing their entrainment at the SWP and CVP pumps.

The purpose of the fall HORB is to improve dissolved oxygen levels in the San Joaquin River between the HORB and Medford Island to aid adult salmon migration in the San Joaquin River.

The three agricultural barriers (Old River near Tracy, Middle River and Grant Line Canal) will help control water levels upstream so that agricultural pumps will have enough pump draft to operate efficiently during each tidal cycle. The channel sections upstream of the barriers will fill with water when the tide is moving into the south Delta and the barrier will keep the water in the channels to increase the opportunities for agricultural pumping. Water quantities are not increased for the South Delta farmers, however, the availability of adequate pump draft and pumping efficiency is improved with the barriers in place.

A. Physical Descriptions of the Proposed Temporary Barriers

1. Head of Old River Barrier (HORB).

This barrier is at the confluence of Old River and the San Joaquin River. The spring barrier will be a rock barrier with six 48-inch operable culverts and a 75-foot notch at an elevation of +6 feet Mean Sea Level (MSL). It is approximately 225 feet long, 85 feet wide at the base of the barrier, has a crest elevation of +10 feet MSL, and is composed of approximately 12,500 tons of rock. The fall barrier is similar in design except that the fall barrier is smaller in size. It will be constructed with six 48-inch operable culverts and a 20-foot notch at an elevation of 0 feet MSL. It is approximately 225 feet long, 55 feet wide at the base of the barrier, has a crest elevation of +4 feet MSL, and is composed of approximately 7,500 tons of rock.

In the past, all HORB components were removed from the channel when the barrier was removed. Sometime within the next seven years' installation, DWR proposes to leave the culverts in place at the southern abutment throughout the year. This will improve the safety during emergency breaching and reduce the construction time and cost. This proposal requires further design and analysis, and will be revisited with the permitting agencies for possible implementation in 2002.

2. Old River near Tracy (ORT) Barrier.

The Old River near Tracy (ORT) barrier is located near the Tracy Pumping Plant, in Old River approximately 0.5 miles east of Delta-Mendota Canal. The barrier is approximately 2,500 cubic yards of rock and sand, 250 feet long, and 60 feet wide. It has nine 48-inch culverts, each 56 feet long, with flapgates. The invert of the pipe is installed to minus 6.0 feet (MSL). The structure allows tidal flows to enter the channel upstream of the barrier and be retained as the tide ebbs. This will allow agricultural pumps to operate throughout each tidal cycle.

The ORT barrier will be constructed with boat portage facilities that consist of two boat launching ramps and an operated vehicle that can tow a universal boat trailer. The boat launching ramps are constructed along the north bank of Old River, allowing boater access and portage on each side of the barrier. The ramps are constructed as a floating dock system and surfaced with concrete matting.

When barrier operations have concluded all rock is removed and stockpiled nearby for future use. The installation of this facility in the channel does not compromise the integrity of the levees or impede flood flows.

3. Middle River Barrier (MR).

The Middle River (MR) barrier is a rock barrier constructed with a removable center section. It consists of approximately 2,300 cubic yards of rock and sand placed across Middle River. The MR barrier will have six 48-inch culverts with flap-gates on the upstream ends, placed three near each abutment of the barrier, and a 140-foot center notch at an elevation of + 1 foot MSL. It is approximately 270 feet long and 50 wide at the base. The barrier abutments will remain in place throughout the year. The flap-gates will permit tidal flow to enter the channel upstream of the barrier and retain water there as the tide ebbs. The tide gates will be tied open when the center section is removed. The existing boat portage facility at this site is a gravel ramp, which can be used to carry or drag a small boat across the barrier.

4. Grant Line Canal Barrier (GLC).

The Grant Line Canal (GLC) barrier is constructed of approximately 12,600 tons of rock, and has a 140-foot wide weir. The weir has the flexibility to be operated at elevations between minus 1.0 and plus 1.0 foot MSL, as needed to maintain adequate water circulation. It is approximately 300 feet long and 50 feet wide at the base. The elevation of the barrier abutments will be +2 feet MSL. The barrier also includes six 48-inch diameter culverts with flapgates on the upstream end of the culverts to permit tidal flow to enter the channel upstream and be retained as the tide ebbs. The flapgates can be tied open if required, or when the HORB is concurrently operating. The culverts are installed under the abutment on the south side of the canal, allowing the abutment to remain in place throughout the year. A boat portage facility, similar to the one at the Tracy barrier, will be provided on the north side of the canal. A flashboard structure will be installed

near the south abutment to provide Delta smelt passage during the spring.

B. Barrier Operation Schedule

1. Head of Old River Barrier.

This spring HORB shall not be fully closed or operated until April 15. The barrier shall be completely removed by May 15 unless the fishery agencies (DFG, FWS, NMFS) request it remain operating until May 31. Initiation of installation and operation of the fall HORB is at the discretion of the DFG. The fall barrier historically has been operated from mid September through the end of November in most years. The fall HORB shall be completely removed by November 30. The fall HORB shall have a notch created and left in place until the barrier is removed, to allow for passage of adult migrating salmon.

2. Old River at Tracy Barrier.

This barrier shall not be fully closed or operated until April 15. If the HORB is not installed, or is installed and then removed prior to May 31, the Old River near Tracy barrier flap gates shall be secured in an open position until June 1. The barrier shall be breached by October 31 and completely removed by November 7. However, if the fall HORB is installed, the Old River near Tracy barrier may remain operating in November. The barrier shall then be completely removed by November 30. Beginning September 15, the Old River near Tracy barrier shall have a notch created and left in place until the barrier is removed, to allow for passage of adult migrating salmon.

3. Middle River Barrier.

This barrier shall not be fully closed or operated until on or after March 1. If the HORB is not installed, or is installed and then removed prior to May 31, the Middle River barrier flap gates shall be secured in an open position until June 1. The barrier shall be breached by October 31 and completely removed by November 7. However, if the fall HORB is installed, the Middle River barrier may remain operating in November. The barrier shall then be completely removed by November 30. Beginning September 15, the Middle River barrier shall have a notch created and left in place until the barrier is removed, to allow for passage of adult migrating salmon.

4. Grant Line Canal Barrier.

This barrier shall not be fully closed or operated until April 15 whenever the spring HORB is installed and operating. During the April 15—May 31 period, the barrier flap gates shall be secured in an open position, the weir section shall be constructed to a reduced height of 0.5 feet MSL, and a flash board structure shall be installed on the south embankment to allow for passage of Delta smelt. If no spring HORB is installed, the Grant Line Canal barrier shall not begin installation until May 15, and shall not be fully closed and operated until June 1. The barrier

weir height shall remain at 0.5 feet MSL until June 15, when it may be raised to the normal operational height of 1.0 feet MSL. The flash board structure will also operate continuously until June 15. The barrier shall be breached by October 31 and completely removed by November 7. However, if the fall HORB is installed, the Grant Line Canal barrier may remain operating in November. The barrier shall then be completely removed by November 30. Beginning September 15, the Grant Line Canal barrier shall have a notch created and left in place until the barrier is removed, to allow for passage of adult migrating salmon.

In the event that the spring HORB cannot be installed due to flows in the San Joaquin River in excess of 5,000 cfs, the Grant Line Canal Barrier may be installed in conjunction with the Middle River and Old River near Tracy barriers to create a hydraulic barrier. Under this scenario, the barrier shall not be fully closed or operated until April 15. Installation for the purposes of a hydraulic barrier is at the discretion of the fishery agencies, which will receive at least two weeks advance notice of the anticipated installation by DWR.

C. Spring barrier operation agreement with USFWS.

During the section 7 consultation process the following spring operation agreement between the DWR and USFWS was developed and has been incorporated into the proposed operation schedule for the TBP:

1. The MR barrier may be installed as early as March 1 at the discretion of the FWS. Such early installation will depend upon the rate of export at the CVP and SWP as well as the most recent scientific data available on delta smelt that shows successful adult migration and spawning. In the absence of an early installation of the MR barrier at FWS's discretion, the MR barrier may begin construction on April 7 and be fully operated from April 15 to May 15, provided that the Head of Old River barrier is operated concurrently. If, during the April 15 to May 15 period, the Head of Old River barrier is installed and subsequently removed prior to May 15, the flap gates on the MR barrier shall be secured in the open position from the time that the Head of Old River barrier is breached through May 15. If the Head of Old River barrier is not installed during the April 15 to May 15 period, the MR barrier may begin construction on May 7 and be fully operated after May 15. Between May 15 to June 1, the flapgates on the MR barrier will only be closed if the need for full operation of the MR barrier is clearly demonstrated by DWR through forecasting water levels by Delta modeling and/or by actual stage data collected in the field (such data shall be provided to the FWS prior to closing the flapgates). The MR barrier shall be completely removed by November 30.

2. The ORT barrier may begin construction on April 1 and be fully operated from April 15 to May 15, provided that the Head of Old River barrier is operated concurrently. In-water work to construct the ORT barrier shall not commence before April 7. If, during the April 15 to May 15 period, the Head of Old River barrier is installed and subsequently removed prior to May 15, the flap gates on the ORT barrier shall be secured in the open

position from the time that the Head of Old River barrier is breached through May 15. If the Head of Old River barrier is not installed during the April 15 to May 15 period, the ORT barrier may begin construction on May 1 and be fully operated after May 15. . Between May 15 to June 1, the flapgates on the ORT barrier will only be closed if the need for full operation of the ORT barrier is clearly demonstrated by DWR through forecasting water levels by Delta modeling and/or by actual stage data collected in the field (such data shall be provided to the FWS prior to closing the flapgates). The ORT barrier shall be completely removed by November 30.

3. The northern abutment and boat ramp of the GLC barrier may begin construction on April 1 provided that the Head of Old River barrier is being constructed concurrently. Closing of the flap gates on the south abutment and the center section of the GLC barrier may commence beginning or after April 15 if the Head of Old River barrier is concurrently in operation and if the need for full operation of the GLC barrier is clearly demonstrated by DWR through forecasting water levels by Delta modeling and/or by actual stage data collected in the field (such data shall be provided to the FWS prior to closing the center and south sections of the barrier). If the Head of Old River barrier is installed and subsequently removed prior to May 15 because of high flows, the flap gates on the GLC barrier shall be tied in the open position from the time that the Head of Old River barrier is breached through May 15. If the Head of Old River barrier is installed and removed prior to May 15 because of Delta smelt concerns, the GLC barrier shall not be fully operated prior to May 15 or, if the GLC barrier is already installed, then the center section of the GLC barrier shall be removed and the flap gates on the GLC barrier shall be tied open until May 15, concurrent with the removal of the HORB.

4. If the Head of Old River barrier is not installed due to high flows, then the northern abutment and boat ramp of the GLC barrier may begin construction on May 1. Closing of the flap gates on the south abutment and the center section of the GLC barrier may commence anytime on or after May 15 providing that 1) the need for full operation of the GLC barrier is clearly demonstrated through forecasting water levels by Delta modeling and/or by actual stage data collected in the field (such data shall be provided to the FWS prior to closing the center and south section flap gates of the barrier) and 2) the yellow light trigger for Delta smelt is not in effect. If the GLC barrier is fully closed and subsequently, the yellow light trigger is tripped, the FWS may require DWR to remove the center section of the GLC barrier and open the flap gates on the south abutment, but only after reductions in project exports consistent with Condition 5 below are determined by FWS to be inadequate to protect Delta smelt. In that event, the center section of the GLC barrier and the flap gates on the south abutment shall not be replaced and closed, respectively, until the FWS determines it is appropriate. It is the expectation of the FWS that such determination would be made at or about the same time that project exports would be permitted to resume to normal levels. The GLC barrier shall be completely removed by November 30.

5. Both prior to and after a yellow light is triggered, actions shall be taken to protect and improve conditions for delta smelt and minimize entrainment at the CVP and SWP export facilities to avoid the triggering of a yellow or red light. Such actions shall include, but not be limited to: 1) reoperation of the culverts and flap gates on installed temporary barriers, 2) use of the joint point of diversion, and 3) reductions in project exports. Export reductions taken as the result of recommendations by USFWS to improve conditions for Delta smelt will be covered by the Environmental Water Account (EWA) and/or by CVPIAb(2) water. Export reductions taken by the projects to improve south Delta water levels in combination with changes in the operation of culverts and flap gates on installed temporary barriers will not be covered by EWA water.

6. In the event that the red light trigger is tripped, one of the following two actions shall immediately be taken by DWR and Reclamation to improve conditions for Delta smelt:

   a. the HORB (if installed) shall be removed, the center section of the GLC barrier shall be removed and the flap gates on the south abutment of the GLC barrier shall be opened. The center section of the GLC barrier and the flap gates on the south abutment shall not be replaced and closed, respectively, until the FWS determines it is appropriate. It is the expectation of the FWS that such determination would be made at or about the same time that project exports would be permitted to resume to normal levels, or

   b. SWP and CVP exports would be reduced to further levels determined by DWR and Reclamation as necessary to protect south Delta water levels. Such reductions, if made during times when the center section of the GLC barrier remains in place, would not be covered by EWA water.

7. In the event that the spring Head of Old River barrier is not installed between April 15 through May 15 , FWS, at its discretion, may allow installation and operation of the MR, ORT and GLC barrier from April 15 through May 15 to test the "hydraulic barrier" concept.

8. The spring HORB installation shall begin on April 1 but shall not be fully operated until April 15. The HORB shall be operated through May 15. At the discretion of the Fishery Agencies, the HORB may continue operation until May 31 or be breached at any time consistent with Condition 6 above.

9. Installation of the fall HORB shall be at the discretion of FWS. Any barrier operating after September 15 shall be notched beginning September 15 to allow for passage of adult salmon.

10. During times of Environmental Water Account (EWA) expenditures or CVPIA b(2) water use directly related to CVP and/or SWP export curtailments, the flap-gates on the

MR, ORT and GLC barriers shall be secured in the open position.

11. The CALFED Final Programmatic EIR/EIS recognized that additional measures may be necessary to help south Delta agricultural diverters when the HORB is closed: "Construction of barriers on other south Delta channels, such as Middle River and Old River near Tracy fish facility, **or their functional equivalent** (emphasis added), may be necessary to alleviate the reduced water levels caused by the closure of the head of Old River barrier in combination with CVP and SWP exports." To pursue the possibility of providing functional equivalence , DWR shall take the following actions:

a. During the time that any of the temporary barriers are installed, if any diverter within the SDWA notifies DWR that they are experiencing water level problems, DWR shall notify FWS in writing of the diverter who is experiencing the problem and the nature and extent of the problem.

b. If renting or installing portable pumps may alleviate the immediate problem, DWR shall provide the portable pumps if feasible or reimburse the diverter for the rental costs of the portable pumps.

c. DWR shall conduct an investigation of whether it is feasible to solve the diverter's water supply problem through dredging and/or modification or relocation of the diverter's intake structure in lieu of barrier operation and submit a written report to FWS on the conclusions of the investigation.

d. If the investigation concludes that dredging and/or or modification or relocation of the diverter's intake structure is a feasible alternative to protect the diverter's water supply in lieu of operation of one or more of the barriers, DWR shall work in earnest to obtain permits and agreements necessary to accomplish the proposed work, including appropriate cost sharing arrangements. The work is to be accomplished at the earliest possible date. If the work involves modifying or relocating an existing diversion intake, a copy of the Memorandum of Agreement Regarding Fish Screens must be signed by the diverter prior to any work taking place. Immediately after any dredging and/or diversion extension, DWR shall provide the FWS with a report detailing the work and the amount of shallow water habitat affected by such actions. DWR shall mitigate these impacts at a ratio to be determined by FWS.

e. To facilitate the actions proposed in Condition 11d), DWR shall submit a Programmatic Application to complete the actions proposed in Condition 11.d. within 30 days of receipt of this Biological Opinion.

D. Geographic Scope and Action Area of the Proposed Temporary Barriers Program.

The geographic scope of the Temporary Barriers Project is the south Sacramento-San Joaquin Delta and generally comprises the lands and waterways of the Delta southwest of the City of Stockton. Major waterways within the south Delta include the San Joaquin River, Old River, Middle River, Woodward and North Victoria Canals, Grant Line and Fabian Canals, Italian Slough, Tom Paine Slough and the adjoining Canals of the Central Valley Project (CVP) and Stater Water Project (SWP). However, due to anticipated indirect and interrelated affects of the project the action area for this consultation not only encompasses the lands and waterways described above but includes lands and waterways of the central Delta including the lower San Joaquin downstream of Old River, Columbine Cut and Turner Cut, and all reaches of Middle River and Old River and adjoining sloughs and canals.

III. LISTED SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects of the described DWR Temporary Barriers Program (TBP) in the south Delta on the following Federally listed species and their designated critical habitat : (1) threatened Central Valley steelhead (*Oncorhynchus mykiss*); (2) threatened Central Valley spring-run chinook salmon (*O. tshawytscha*); and, (3) endangered Sacramento River winter-run chinook salmon (*O. tshawytscha*). These species may be adversely affected by construction and/or operation of the TBP.

A. Central Valley Steelhead - Threatened:

1. Population Trends, Life History, and Biological Requirements

On March 19, 1998 NMFS listed Central Valley steelhead as threatened under the Endangered Species Act (63 FR 13347). Central Valley steelhead once ranged throughout most of the tributaries and headwaters of the Sacramento and San Joaquin basins prior to dam construction, water development, and watershed disturbance of the 19th and 20th centuries (McEwan and Jackson 1996). Historical documentation exists that show steelhead were once widespread throughout the San Joaquin River system (CALFED 1999). In the early 1960s, the California Fish and Wildlife Plan estimated a total run size of about 40,000 adults for the entire Central Valley including San Francisco Bay (DFG 1965). The annual run size for Central Valley steelhead in 1991-92 was probably less than 10,000 fish based on dam counts, hatchery returns and past spawning surveys (McEwan and Jackson 1996).

Estimates of steelhead historical habitat can be based on estimates of salmon historical habitat. The extent of habitat loss for steelhead is probably greater than losses for salmon, because steelhead go higher into the drainages than do chinook salmon (Yoshiyama et al. 1996). Clark (1929) estimated that originally there were 6,000 miles of salmon habitat in the Central Valley system and that 80% of this habitat had been lost by 1928. Yoshiyama et al. (1996) calculated

that roughly 2,000 miles of salmon habitat was actually available before dam construction and mining, and concluded that 82% of what was present is not accessible today. Clark (1929) did not give details about his calculation. Whether Clark's or Yoshiyama's calculation is used, only remnants of the former steelhead range remain accessible today in the Central Valley.

As with Central Valley spring-run chinook, impassable dams block access to most of the historical headwater spawning and rearing habitat of Central Valley steelhead. In addition, much of the remaining, accessible spawning and rearing habitat is severely degraded by elevated water temperatures, agricultural and municipal water diversions, unscreened and poorly screen water intakes, restricted and regulated stream flows, levee and bank stabilization, and poor quality and quantity of riparian and SRA cover.

At present, wild steelhead stocks appear to be mostly confined to upper Sacramento River tributaries such as Antelope, Deer, and Mill creeks and the Yuba River (McEwan and Jackson 1996). Naturally spawning populations are also known to occur in Butte Creek, and the upper Sacramento, Feather, American, Mokelumne, and Stanislaus Rivers (CALFED 1999). However, the presence of naturally spawning populations appears to correlate well with the presence of fisheries monitoring programs, and recent implementation of new monitoring efforts has found steelhead in streams previously thought not to contain a population, such as Auburn Ravine, Dry Creek, and the Stanislaus River. It is possible that other naturally spawning populations exist in Central Valley streams, but are undetected due to lack of monitoring or research programs (IEP Steelhead Project Work Team 1999).

All Central Valley steelhead are currently considered winter-run steelhead (McEwan and Jackson 1996), although there are indications that summer steelhead were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940's (IEP Steelhead Project Work Team 1999). Adult steelhead migrate upstream in the Sacramento River mainstem from July through March, with peaks in September and February (Bailey 1954; Hallock et al. 1961). The timing of upstream migration is generally correlated with higher flow events, such as freshets or sand bar breaches, and associated lower water temperatures. The preferred temperatures for upstream migration are between 46° F and 52° F (Reiser and Bjornn 1979, Bovee 1978, Bell 1986).

Spawning may begin as early as late December and can extend into April with peaks from January through March (Hallock et al. 1961). Unlike chinook salmon, not all steelhead die after spawning. Some may return to the ocean and repeat the spawning cycle for two or three years; however, the percentage of repeat spawners is generally low (Busby et al. 1996). Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may be used for spawning (Barnhart 1986; Everest 1973).

Length of time required for eggs to develop and hatch is dependant on water temperature and is quite variable; hatching varies from about 19 days at an average temperature of 60° F to about 80 days at an average of 42° F. The optimum temperature range for steelhead egg incubation is 46°

F to 52° F (Reiser and Bjornn 1979, Bovee 1978, Bell 1986, Leidy and Li 1987). Egg mortality may begin at temperatures above 56° F (McEwan and Jackson 1996).

After hatching, pre-emergent fry remain in the gravel living on yolk-sac reserves for another four to six weeks, but factors such as redd depth, gravel size, siltation, and temperature can speed or retard this time (Shapovalov and Taft 1954). Upon emergence, steelhead fry typically inhabit shallow water along perennial stream banks. Older fry establish territories which they defend. Stream side vegetation is essential for foraging, cover, and general habitat diversity. Steelhead juveniles are usually associated with the bottom of the stream. In winter, they become inactive and hide in available cover, including gravel or woody debris.

The majority of steelhead in their first year of life occupy riffles, although some larger fish inhabit pools or deeper runs. Juvenile steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Water temperatures influence the growth rate, population density, swimming ability, ability to capture and metabolize food, and ability to withstand disease of these rearing juveniles. Rearing steelhead juveniles prefer water temperatures of 45° F to 60° F (Reiser and Bjornn 1979, Bovee 1978, Bell 1986). Temperatures above 60° F have been determined to induce varying degrees of chronic stress and associated physiological responses in juvenile steelhead (Leidy and Li 1987).

After spending one to three years in freshwater, juvenile steelhead migrate downstream to the ocean. Most Central Valley steelhead migrate to the ocean after spending two years in freshwater (Hallock et al. 1961, Hallock 1989). Barnhart (1986) reported that steelhead smolts in California range in size from 14 to 21 cm (fork length). In preparation for their entry into a saline environment, juvenile steelhead undergo physiological transformations known as smoltification that adapt them for their transition to salt water. These transformations include different swimming behavior and proficiency, lower swimming stamina, and increased buoyancy that also make the fish more likely to be passively transported by currents (Saunders 1965, Folmar and Dickhoff 1980, Smith 1982). In general, smoltification is timed to be completed as fish are near the fresh water to salt water transition. Too long a migration delay after the process begins is believed to cause the fish to miss the "biological window" of optimal physiological condition for the transition (Walters et al. 1978). The optimal thermal range during smoltification and seaward migration for steelhead is 44° F to 52° F (Leidy and Li 1987, Rich 1997) and temperatures above 55.4° F have been observed to inhibit formation and decrease activity of gill (Na and K) ATPase activity in steelhead, with concomitant reductions in migratory behavior and seawater survival (Zaugg and Wagner 1973, Adams et. al 1975). Hallock et al. (1961) found that juvenile steelhead in the Sacramento Basin migrated downstream during most months of the year, but the peak period of emigration occurred in the spring, with a much smaller peak in the fall.

Steelhead spend between one and four years in the ocean (usually one to two years in the Central Valley) before returning to their natal streams to spawn (Barnhart 1986, Busby et al. 1996).

2. Critical Habitat

On February 16, 2000 NMFS designated critical habitat for the Central Valley steelhead ESU (65 FR 7764). Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of steelhead. Inaccessible reaches are those above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and specific dams within the historical range of each ESU.

Critical habitat for Central Valley steelhead is designated to include all river reaches accessible to listed steelhead in the Sacramento and San Joaquin Rivers and their tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas of the San Joaquin River upstream of the Merced River confluence and areas above specific dams or above longstanding naturally impassable barriers.

B. Central Valley Spring-run Chinook Salmon - Threatened:

1. Population Trends, Life History, and Biological Requirements

Effective November 16, 1999, NMFS listed Central Valley spring-run chinook salmon as threatened under the Endangered Species Act (64 FR 50394). Historically, spring-run chinook salmon were predominant throughout the Central Valley, occupying the upper and middle reaches of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud, and Pit Rivers, with smaller populations in most other tributaries with sufficient habitat for over-summering adults (Stone 1874, Rutter 1904, Clark 1929). The Central Valley drainage as a whole is estimated to have supported spring-run chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (DFG 1998). Before the construction of Friant Dam, nearly 50,000 adults were counted in the San Joaquin River (Fry 1961). Following the completion of Friant Dam, the native population from the San Joaquin River and its tributaries was extirpated. Also, spring-run no longer exist in the American River due to Folsom Dam.

Impassable dams block access to most of the historical headwater spawning and rearing habitat of Central Valley spring-run chinook salmon. In addition, much of the remaining, accessible spawning and rearing habitat is severely degraded by elevated water temperatures, agricultural and municipal water diversions, unscreened and poorly screen water intakes, restricted and regulated stream flows, levee and bank stabilization, and poor quality and quantity of riparian and shaded riverine aquatic (SRA) cover.

Natural spawning populations of Central Valley spring-run chinook salmon are currently

restricted to accessible reaches in the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and Yuba River (DFG 1998; USFWS, unpublished data). With the exception of Butte Creek and the Feather River, these populations are relatively small ranging from a few fish to several hundred. Butte Creek returns in 1998 and 1999 numbered approximately 20,000 and 3,600, respectively (DFG unpublished data).

Spring-run chinook salmon adults are estimated to leave the ocean and enter the Sacramento River from March to July (Myers et al. 1998). When they enter freshwater, spring-run chinook salmon are immature and they must stage for several months before spawning. Their gonads mature during their summer holding period in freshwater. Over-summering adults require cold-water refuges such as deep pools to conserve energy for gamete production, redd construction, spawning, and redd guarding.

Spawning typically occurs between late-August and early October with a peak in September. Once spawning is completed, adult spring-run chinook salmon die. Spawning typically occurs in gravel beds that are located at the tails of holding pools (USFWS 1995). Eggs are deposited within the gravel where incubation, hatching, and subsequent emergence takes place.

Length of time required for eggs to develop and hatch is dependant on water temperature and is quite variable, however, hatching generally occurs within 40 to 60 days of fertilization (Vogel and Marine 1991). In Deer and Mill creeks, embryos hatch following a 3-5 month incubation period (USFWS 1995).

After hatching, pre-emergent fry remain in the gravel living on yolk-sac reserves for another two to four weeks until emergence. Timing of emergence within different drainages is strongly influenced by water temperature. Emergence of spring-run chinook typically occurs from November through January in Butte and Big Chico Creeks and from January through March in Mill and Deer Creeks (DFG 1998).

Post-emergent fry seek out shallow, near shore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. As they grow to 50 to 75 mm in length, the juvenile salmon move out into deeper, swifter water, but continue to use available cover.

In Deer and Mill creeks, juvenile spring-run chinook, during most years, spend 9-10 months in the streams, although some may spend as long as 18 months in freshwater. Most of these "yearling" spring-run chinook move downstream in the first high flows of the winter from November through January (USFWS 1995, DFG 1998). In Butte and Big Chico creeks, spring-run chinook juveniles typically exit their natal tributaries soon after emergence during December and January, while some remain throughout the summer and exit the following fall as yearlings. In the Sacramento River and other tributaries, juveniles may begin migrating downstream almost immediately following emergence from the gravel with emigration occurring from December

through March (Moyle, et al. 1989, Vogel and Marine 1991). Fry and parr may spend time rearing within riverine and/or estuarine habitats including natal tributaries, the Sacramento River, non-natal tributaries to the Sacramento River, and the Sacramento-San Joaquin Delta. In general, emigrating juveniles that are younger (smaller) reside longer in estuaries such as the Delta (Kjelson et al. 1982, Levy and Northcote 1982, Healey 1991). The brackish water areas in estuaries moderate the physiological stress that occurs during parr-smolt transitions. Although fry and fingerlings can enter the Delta as early as January and as late as June, their length of residency within the Delta is unknown but probably lessens as the season progresses into the late spring months (DFG 1998).

In preparation for their entry into a saline environment, juvenile salmon undergo physiological transformations known as smoltification that adapt them for their transition to salt water (Hoar 1976). These transformations include different swimming behavior and proficiency, lower swimming stamina, and increased buoyancy that also make the fish more likely to be passively transported by currents (Saunders 1965, Folmar and Dickhoff 1980, Smith 1982). In general, smoltification is timed to be completed as fish are near the fresh water to salt water transition. Too long a migration delay after the process begins is believed to cause the fish to miss the "biological window" of optimal physiological condition for the transition (Walters et al. 1978).

Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Myers et al. 1998). Fisher (1994) reported that 87% of returning spring-run adults are three-years-old based on observations of adult chinook trapped and examined at Red Bluff Diversion Dam between 1985 and 1991.

2. Critical Habitat

On February 16, 2000 NMFS designated critical habitat for the Central Valley spring-run chinook salmon Evolutionarily Significant Unit (ESU)(65 FR 7764). Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches. Accessible reaches are those within the historical range of the Central Valley spring-run chinook ESU that can still be occupied by any life stage of chinook salmon. Inaccessible reaches are those above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and specific dams within the historical range of each ESU.

Critical habitat for Central Valley spring-run chinook is designated to include all river reaches accessible to chinook salmon in the Sacramento River and its tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas above specific dams or above longstanding naturally impassable barriers.

C. Sacramento River Winter-run Chinook Salmon - Endangered:

1. Population Trends, Life History, and Biological Requirements

The Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*) is one of four distinct runs of chinook salmon in the Sacramento River and was listed as endangered by NMFS on January 4, 1994 (59 FR 440). Adult winter-run chinook salmon run sizes took a dramatic decline between 1967 and 1980, from an estimated high of 108,855 in 1969 to a low of 84 in 1980. Since 1981 the adult population has stabilized somewhat but has remained at a low level with an average estimated run size of 1,899 adults. Based on the salmon counts at the Red Bluff Diversion Dam (RBDD), the estimated adult winter-run chinook salmon run size for 1999 was 886 adults. In comparison, an estimate of winter-run chinook salmon adult escapement based on carcass surveys jointly conducted by the DFG and USFWS, indicate a run size of 1,820 adults (Snider et al 2000).

Adult winter-run chinook salmon generally leave the ocean and migrate through the Sacramento-San Joaquin Delta to the upper Sacramento River from December through June. The majority of winter-run chinook salmon spawning occurs upstream of Red Bluff Diversion Dam; however, some spawners utilize gravel below the dam. The spawning phase of winter-run chinook salmon primarily occurs from May through July. The eggs are fertilized and buried in the river gravel (redds) where they incubate for approximately two-months.

Emergence of winter-run fry from the gravel begins in early July and continues through September. Juveniles redistribute themselves and rear in the Sacramento River from July through April. The peak emigration of winter-run juveniles through the Sacramento-San Joaquin Delta generally occurs from January through April, but the range of emigration may extend from September through June (Schaffer 1980, Messersmith 1966, California Department of Fish and Game(DFG) 1993, U.S. Fish and Wildlife Service(USFWS) 1992, USFWS 1993, USFWS 1994). Low to moderate numbers may occur as early as October or November, or later in May, depending on water year type, precipitation and accretion to the Sacramento River, and river flows. Distinct emigration pulses appear to coincide with high precipitation and increased turbidity. Juvenile chinook salmon of winter-run size have also been collected in Montezuma Slough in November, following early fall storms in October (Pickard et al. 1982).

2. Critical Habitat

On June 16, 1993, NMFS designated critical habitat for the winter-run chinook salmon (58 FR 33212). Critical habitat for the winter-run chinook salmon includes the Sacramento River from Keswick Dam (RM 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge.

Within the Sacramento River, critical habitat includes the river water, river bottom (including those areas and associated gravel used by winter-run chinook salmon as a spawning substrate), and the adjacent riparian zone used by fry and juveniles for rearing. In areas westward from Chipps Island, including San Francisco Bay to the Golden Gate Bridge, it includes the estuarine water column, essential foraging habitat, and food resources used by the winter-run chinook salmon as part of their juvenile out migration or adult spawning migration.

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and ecosystem within the action area (USFWS and NMFS 1998). The action area for this consultation is the south Sacramento-San Joaquin Delta and generally consists of the lands and waterways of the Delta south and west of the San Joaquin River. Major waterways within the south Delta include the San Joaquin River, Old River, Middle River, Columbine and Turner Cuts, Woodward and North Victoria Canals, Grant Line and Fabian Canals, Italian Slough, Tom Paine Slough and the adjoining Canals of the Central Valley Project (CVP) and Stater Water Project (SWP).

A. Status of the Listed and Proposed Species and Critical Habitat in the Action Area.

Central Valley Steelhead. Historically, the Sacramento-San Joaquin Delta, including the south Delta, has been used by Central Valley steelhead as a migration corridor to and from spawning areas in tributaries upstream of the Delta. Adult and juvenile steelhead are found seasonally within the action area. Salvage records from the CVP and SWP fish facilities indicate peak steelhead migration through the Delta occurs between February and April, with a few smolts salvaged as early as September and as late as July (DWR 2000a).

All emigrating juvenile Central Valley steelhead smolts use the lower reaches of the Sacramento and San Joaquin Rivers and the Delta for rearing and as a migration corridor to the ocean. Some juveniles may use tidal and non-tidal freshwater marshes and other shallow water areas in the Delta as rearing areas for short periods prior to final emigration to the sea.

All adult steelhead use the Delta and lower reaches of the Sacramento and San Joaquin Rivers as migration corridors in their return to natal streams for spawning.

The action area is located within the designated critical habitat of the Central Valley steelhead. Designated critical habitat within the action area ranges from riverine to estuarine areas. The essential elements of critical habitat in these areas are the water, substrate, and adjacent riparian areas.

Central Valley Spring-run Chinook Salmon. Historically, the Sacramento-San Joaquin Delta has been used by Central Valley spring-run chinook salmon as a migration route to and from cooler tributaries upstream. Although historically found in both the San Joaquin and Sacramento

River basins, contemporary spawning populations are primarily found in the Sacramento River basin. Adult chinook salmon may still be found seasonally within the action area. Based on size classification and salvage records from the CVP and SWP fish facilities at the Delta pumps juvenile spring-run chinook are found during the spring months within the action area.

All of the emigrating juvenile, sub-yearling and yearling, Central Valley spring-run chinook salmon use the Delta during emigration to the ocean. Some juveniles may use tidal and non-tidal freshwater marshes and other shallow water areas in the Delta as rearing areas for short periods prior to final emigration to the sea.

All adult steelhead use the Delta and lower reaches of the Sacramento and San Joaquin Rivers as migration corridors in their return to natal streams for spawning.

The action area is located within the designated critical habitat of the Central Valley spring-run chinook salmon Designated critical habitat within the action area ranges from riverine to estuarine areas. The essential elements of critical habitat in these areas are the water, substrate, and adjacent riparian areas.

Sacramento River Winter-run Chinook Salmon. Historically, the Sacramento-San Joaquin Delta has been used by Sacramento River winter-run chinook salmon as a migration route to and from cooler tributaries upstream. Although historically found in both the San Joaquin and Sacramento River basins, present day spawning populations are primarily found in the Sacramento River basin. Based on size classification and salvage records from the CVP and SWP fish facilities at the Delta pumps juvenile winter-run chinook are found during the spring months within the action area.

All of the emigrating juvenile, sub-yearling and yearling, Sacramento River winter-run chinook salmon use the Delta during emigration to the ocean. Some juveniles may use tidal and non-tidal freshwater marshes and other shallow water areas in the Delta as rearing areas for short periods prior to final emigration to the sea.

All adult Sacramento River winter-run use the Delta and lower reaches of the Sacramento River and possibly the San Joaquin River as migration corridors spawning reaches in the upper Sacramento River basin.

The action area is not within the designated critical habitat of Sacramento River winter-run chinook salmon. Designated critical habitat ranges from riverine to estuarine areas within the lower Sacramento River near the action area. The essential elements of critical habitat in these areas are the water, substrate, and adjacent riparian areas.

B. Factors Affecting Species Environment within the Action Area

The essential features of freshwater and estuarine salmonid habitat include adequate (1)

substrate; (2) water quality; (3) water quantity; (4) water temperatures; (5) water velocity; (6) cover and shelter; (7) food; (8) riparian vegetation; (9) space; and, (10) safe passage conditions. These features have been affected by human activities such as water management, flood control, agriculture, and urban development throughout the action area. Impacts to these features have led to salmonid population declines significant enough to warrant the listing of several salmonid species in California's Central Valley.

High water quality and quantity are essential for survival, growth, reproduction, and migration of individuals dependent on riparian and aquatic habitats. Important water quality elements include flows adequate to support the migratory, rearing, and emergence needs of fish and other aquatic organisms. Desired flow conditions for salmonids include an abundance of cool, well-oxygenated water with low levels of suspended and deposited sediments or other pollutants that could limit primary production and/or invertebrate abundance and diversity. Safe passage throughout the migration route is also critical to both adult and juvenile salmon and steelhead.

Habitat Impacts in the Sacramento-San Joaquin Delta. The Sacramento River Basin provides approximately 75 percent of the water flowing into the Delta while the San Joaquin River Basin and eastside tributaries provide the remainder (DWR 1993). With the completion of upstream reservoir storage projects throughout the Central Valley, the seasonal distribution of flows into the Delta differs substantially from historical patterns. The magnitude and duration of peak flows during the winter and spring are reduced by water impoundment in upstream reservoirs. Instream flows during the summer and early fall months have increased over historic levels for deliveries of municipal and agricultural water supplies. Overall, water management now reduces natural variability by creating more uniform flows year-round.

Juvenile salmonids migrate downstream from their upper river spawning and nursery grounds to lower river reaches and the Delta prior to entering the ocean as smolts. To a great extent, streamflow volume, runoff patterns and circulation patterns within the Delta regulate the quality and quantity of habitat available to juvenile salmonids. Salmon and steelhead are highly adapted to seasonal changes in flow. Increased stream flows in the fall and winter stimulate juvenile salmonid downstream migration, improve rearing habitat, and improve smolt survival to the ocean. Changes in runoff patterns from upstream reservoir storage to the Delta have adversely affected Central Valley salmonids, including winter-run chinook salmon, spring-run chinook salmon and steelhead, through reduced survival of juvenile fish. In addition, changes in circulation patterns within the Delta due to operation of the CVP and SWP export pumps in the south Delta, near Tracy, have adversely affected listed salmonids.

Historically, the tidal marshes of the Delta provided a highly productive estuarine environment for juvenile salmonids. During the course of their downstream migration, juvenile salmon and steelhead utilize the Delta's estuarine habitat for seasonal rearing, and as a migration corridor to the sea. Since the 1850's, reclamation of Delta islands for agricultural purposes caused the cumulative loss of 94 percent of the Delta's tidal marshes (Monroe et al 1992).

In addition to the degradation and loss of estuarine habitat, downstream migrant juvenile salmonids in the Delta have been subject to adverse conditions created by water export operations of the CVP and SWP. Specifically, juvenile salmon have been adversely affected by: (1) water diversion from the mainstem Sacramento River into the Central Delta via the manmade Delta Cross Channel, Georgiana Slough, and Three-mile Slough; (2) upstream or reverse flows of water in the lower San Joaquin River and southern Delta waterways; and (3) entrainment at the CVP and SWP export facilities near Tracy and associated problems at Clifton Court Forebay. In addition, salmonids are exposed to increased water temperatures from late spring through early fall in the lower Sacramento River and San Joaquin River reaches and the Delta. These temperature increases are primarily caused by the loss of riparian shading, and by thermal inputs from municipal, industrial, and agricultural discharges.

Recent habitat restoration initiatives sponsored and funded primarily by the CALFED Program have resulted in plans to restore ecological function to over several thousands acres of habitat within the Delta. During the past three years, approximately 1,500 acres of land have been purchased for restoration activities. Restoration of these areas primarily involves flooding lands previously used for agriculture, thereby creating additional rearing habitat for juvenile salmonids.

V. ASSESSMENT OF IMPACTS

Potential adverse impacts of the proposed Temporary Barriers Project on listed salmon and steelhead are anticipated to occur during construction and operation through blocked passage and altered flow patterns through south Delta channels due to barrier installation and operation.

A. Construction Impacts

Construction activities may temporarily impact salmon and/or steelhead smolts during emigration. The placement of rock fill for the barriers may harass and/or displace juvenile salmonids present in the general area of the construction activity. Additionally, increased turbidity levels associated with construction may negatively impact salmon and steelhead in the area. These impacts, however, are expected to be temporary in nature.

B. Passage Impacts

The physical presence of the TBP facilities may block the passage of migrating adult and juvenile salmon and steelhead through the south Delta. However, adult migrating Central Valley spring-run and Sacramento River winter-run are unlikely to experience an impact to migration since these races currently spawn only in the Sacramento River basin and are not expected to use the south Delta area as a migration corridor. Additionally, Department of Fish and Game (DFG) fish monitoring data suggest that adult salmon are rare in the south Delta. Monitoring in Grant Line Canal, Middle River, and Old River at Tracy during 1997 and 1998 resulted in only one adult

chinook salmon being captured (DWR 2000a).

The TBP may pose a passage problem for adult steelhead. However, the degree of this impact can not be quantified. Incidental catches of steelhead, during salmon monitoring programs, indicate that adult steelhead may be present in the south Delta during the time that the TBP is operating (DWR 2000b). Regardless, in over eight years of sampling by DFG, no steelhead were reported to be captured within the south Delta, outside of the San Joaquin River. Therefore, impacts of the TBP on adult steelhead are not expected to be measurable as long-term effects on Central Valley steelhead populations.

Juvenile Central Valley spring-run chinook salmon and Sacramento River winter-run chinook salmon passage is not expected to be affected by installation of the TBP since these races originate in the Sacramento River basin and are not expected to travel through the south Delta during migration to the sea. More likely, adverse impacts to spring-run and winter-run juveniles will result from changes in the hydrogy of the south Delta as a result of installation and/or operation of the TBP. These impacts are discussed in the following section.

Passage of juvenile Central Valley steelhead, emigrating from rearing areas in the San Joaquin basin, may be affected by the TBP. However, installation of the Head of Old River Barrier (HORB) during the spring months is anticipated to benefit Central Valley steelhead by diverting emigrating juveniles through the central Delta and away from the unscreened diversions of the south Delta.

C. Hydrologic Impacts

The proposed TBP will alter water circulation patterns within the south Delta. When all four barriers are in operation, incoming tide will be impounded between the upstream channels of the three agricultural barriers and the HORB. Under this configuration, flap gates on Grant Line Canal barrier will be tied open to allow downstream flow and improve circulation. Also, the barrier weir height will be reduced from 1.0 feet MSL to 0.5 feet MSL in the spring and a flash board structure will be installed to further improve circulation and fish passage. If the spring HORB is not installed, or is installed and then removed prior to May 31, the flap gates on the 3 agricultural barriers (Old River near Tracy, Middle River and Grant Line Canal) will be secured in the open position at least until May 15. Between May 15 and June 1 the flap gates on these barriers will only be closed if the need for full operation is clearly demonstrated by DWR through forecasting water levels by Delta models and/or by actual stage data collected in the field.

D. Overall Impacts

Installation and operation of the proposed Head of Old River Barrier (HORB) is not expected to

directly affect Central Valley spring-run chinook salmon or Sacramento River winter-run chinook salmon. Installation and operation of the HORB is anticipated to have an overall beneficial effect on the survival and recovery of Central Valley steelhead and chinook salmon populations originating in the San Joaquin basin by diverting emigrating juveniles through the central Delta and away from the unscreened diversions of the south Delta. However, the TBP has the potential to indirectly affect Central Valley steelhead, Central Valley spring-run chinook salmon and/or Sacramento River winter-run chinook salmon through interrelated effects when combined with CVP and SWP operations.

Although the exact number of individual Central Valley steelhead, Central Valley spring-run chinook salmon and Sacramento River winter-run chinook salmon, directly of indirectly affected within the action area of the TBP that will experience adverse effects due to implementation of the proposed project is unknown, the NMFS anticipates that the numbers will be small relative to the Central Valley populations of these species as a whole. This determination is based on the relatively small footprint of the 4 barriers proposed, the expected beneficial effects of the HORB, and limited habitat disturbance associated with project construction. Additionally, any potential indirect effects due to installation and operation of the TBP are confined to a relatively small area and are addressed through biological opinions for CVP/SWP operations.

Therefore, the NMFS anticipates that the level of harm, harassment, and mortality resulting from the installation and operation of the TBP will be negligible and is not expected to appreciably reduce the likelihood of survival and recovery of Central Valley steelhead, Central Valley spring-run chinook salmon and Sacramento River winter-run chinook salmon populations within the designated Ecologically Significant Units (ESU's).

In addition, the TBP is not anticipated to diminish the value of designated critical habitat for survival and recovery of Central Valley steelhead, Central Valley spring-run chinook salmon and Sacramento River winter-run chinook salmon.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Non-Federal actions that may affect the action area include State angling regulation changes, voluntary State or private sponsored habitat restoration activities, agricultural practices, increased population growth, dredging activities, and urbanization. State angling regulations are generally moving towards greater restrictions on sport fishing to protect listed fish species. Habitat restoration projects may have short-term negative effects associated with in-water construction work, but these effects are temporary, localized, and the outcome is a benefit to these listed

species. Farming activities within or adjacent to the action area may have negative effects on water quality due to runoff laden with agricultural chemicals. Future urban development and dredging operations in the action area may adversely affect water quality, riparian function, and stream productivity. However, future land conservation and habitat restoration activities expected in the action area, such as those planned by the ongoing CALFED process, are anticipated to offset many of these adverse effects.

VII. CONCLUSION

Based on the best available information and analysis in this biological opinion, the proposed DWR Temporary Barriers Program is not likely to jeopardize the continued existence of threatened Central Valley steelhead, threatened Central Valley spring-run chinook salmon, or endangered Sacramento River winter-run chinook salmon and is not likely to destroy or adversely modify designated critical habitat. In arriving at this conclusion, the NMFS considered the status of the listed salmon and steelhead, environmental baseline conditions, the direct and indirect effects of approving the action, and the cumulative effects of actions anticipated in the action area. The NMFS evaluated the proposed action and found that it may cause short-term adverse degradation of some environmental baseline indicators for listed species (i.e. water quality, turbidity, flows). However, the proposed action is not expected to result in further degradation of aquatic habitat critical to listed salmon and steelhead over the long-term.

Notwithstanding this conclusion, the NMFS anticipates that some actions associated with the DWR Temporary Barriers Program may result in incidental take of these species. Therefore, an incidental take statement is included with this Biological Opinion for these actions.

VIII. INCIDENTAL TAKE STATEMENT

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take of a listed animal species that results from, but is not the purpose of, the carrying out of an otherwise lawful activity.

Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA, and the proposed action may incidentally take individuals of a listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided that are necessary to minimize such impacts. Under the terms and conditions of section 7(o)(2) and 7(b)(4), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of the Incidental Take Statement.

The measures described below are non-discretionary. They must be implemented by the Army Corps of Engineers (ACOE) so that they become binding conditions of any permit, grant or contract issued to the California Department of Water Resources (DWR), as appropriate, for the exemption in section 7(o)(2) to apply. The ACOE has a continuing duty to regulate the activity covered in this incidental take statement. If the ACOE (1) fails to assume and implement the terms and conditions of the incidental take statement, and/or (2) fails to require DWR to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, grant or contract document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the ACOE and DWR must report the progress of the action and its impact on the species to NMFS as specified in this incidental take statement (50 CFR §402.14(i)(3)).

A. Amount or Extent of Take

The NMFS anticipates that the proposed DWR Temporary Barriers Project (TBP) in San Joaquin County, California, will result in the incidental take of Central Valley spring-run chinook salmon or Sacramento River winter-run chinook salmon due to altered flows through the south Delta as a result of installation and operation. In addition, the NMFS anticipates that the TBP will result in the incidental take of Central Valley steelhead. Any incidental take resulting from the TBP will most likely be limited to emigrating juveniles entrained within the project area or drawn to the project area due to altered flows through the south Delta as a result of the project installation and operation. The incidental take is expected to be in the form of death, injury, harassment, harm, capture, and collection.

The numbers of Central Valley steelhead directly taken by either construction or operation of the temporary barriers and the numbers of Central Valley steelhead, Central Valley spring-run chinook salmon or Sacramento River winter-run chinook salmon indirectly taken by TBP operation will be difficult to quantify because dead or impaired individuals will be difficult to detect. However, take is expected to include:

1. All juvenile Central Valley steelhead harmed, harassed, or killed from stranding in areas of confined water between barriers, attributable to installation and operation of all 4 barriers. During the period of the TBP, all 4 barriers are expected to be installed and operated between April 15 and May 31, and September 15 to November 30, each year. Stranding of individuals between barriers is expected to be temporary and not exceed 1% as measured by annual estimates of juvenile production; and,

2. All juvenile Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, and Central Valley steelhead harmed, harassed, or killed from entrainment in the CVP/SWP pumps in the south Delta due to altered water circulation patterns. Increases in net aggregate channel flows, as measured by changes in water circulation patterns towards the CVP and SWP pumps attributable to installation and operation of the TBP, are not expected to increase by more than 10% of those which

would occur ordinarily.

B. Effect of the Take

The effect of this action will consist of fish behavior modification, temporary disorientation, and potential death or injury to juvenile Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon and Central Valley steelhead due to the entrainment of fish within the project area or the CVP and/or SWP export pumps through indirect, but interrelated effects of the TBP. However, these effects are largely unquantifiable in and of themselves, and are not expected to be measurable as long-term effects on salmon and steelhead population levels.

In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the listed species.

C. Reasonable and Prudent Measures

The measures described below are non-discretionary, and must be undertaken by the ACOE so that they become binding conditions of any grant or permit issued to the DWR, as appropriate, in order for the exemption in section 7(o)(2) to apply. The ACOE has the continuing duty to regulate the activities covered in this incidental take statement. If the ACOE (1) fails to assume and implement the terms and conditions or (2) fails to require the DWR to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the ACOE or DWR must report the progress of the action and its impact on the species to the NMFS as specified in the incidental take statement [50 CFR §402.14(i)(3)].

The NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize the incidental take of listed species caused by the proposed DWR Temporary Barriers Program.

1. Minimize the likelihood of incidental take from project construction by applying permit conditions to avoid or minimize disturbance to aquatic habitat or riparian systems.

2. Minimize the likelihood of incidental take due to project operation by applying permit conditions to monitor south Delta flows through the project area and developing an operations plan to compensate for indirect incidental take at the CVP and SWP export pumps as a result of installation and operation of the TBP.

D. Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the ACOE is responsible for DWR's compliance with the following terms and conditions that implement the reasonable and

prudent measures described above. These terms and conditions are non-discretionary.

1. **Minimize the likelihood of incidental take from project construction by applying permit conditions to avoid or minimize disturbance to aquatic habitat or riparian systems.**

   a. Construction impacts will be confined to the minimum area necessary to complete project barriers.

   b. Stockpiling of construction materials, including portable equipment, vehicles and supplies, including chemicals and chemical containers, shall be restricted to designated construction staging areas and exclusive of the riparian areas.

   c. Heavy equipment use will be restricted to that having the least impact (e.g. minimally sized, rubber tired, etc)

   d. Heavy equipment used will be fueled, maintained and stored a safe distance from the waterways so that no oil, grease, fuel or other fluids contaminate the waterways around the work sites.

   e. Erosion control measures that prevent soil or sediment from entering the river during construction, or as a result of construction shall be placed, monitored for effectiveness, and maintained throughout construction or as needed.

   f. The NMFS shall be notified immediately via fax (contact: Supervisor, Sacramento Area Office at (916)930-3623) if any salmon or steelhead are found dead or injured within 0.1 mile upstream or downstream of construction sites during barrier installation. A follow-up written notification shall also be submitted to include the date, time, and location that the carcass or injured specimen was found, a color photograph, cause of injury or death, if known, and name and affiliation of the person who found the specimen. Written notification shall be submitted to: Supervisor, Sacramento Area Office, National Marine Fisheries Service, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814. Any dead specimen should be placed in a cooler with ice and held for pickup by NMFS or an individual designated by NMFS.

   g. Within 30 days of completing any construction activity associated with the TBP, the applicant will submit a report to the ACOE and NMFS describing the work that was performed, the starting and ending dates, observed adverse effects to aquatic habitats (i.e. increased sediment levels, pollution, etc) and their duration, and any problem encountered during construction and any adverse effects to salmon or steelhead associated with the construction activities that was not previously considered.

2. **Minimize the likelihood of incidental take due to project operation by applying permit conditions to monitor south Delta flows through the project area and developing an operations plan to compensate for indirect incidental take at the CVP and SWP export pumps as a result of installation and operation of the TBP.**

a. DWR shall design and implement a program to document and monitor flows through the south Delta after installation and during operation of the Head of Old River Barrier and 3 agricultural barriers of the TBP. The program shall include identification and evaluation of flow patterns and water surface elevations within the action area addressed in this biological opinion. This monitoring program must be approved by the NMFS. Information obtained through this program shall serve as a basis for establishing long-term operations criteria for the TBP in association with operations of the CVP and SWP export pumps near Tracy. The program design shall be submitted to the NMFS by May 1 and shall include a description of the planned monitoring activities, locations and schedule.

b. DWR shall design and implement a fishery sampling program within the project area of the TBP to monitor for the presence and/or distribution of salmon and steelhead during operation. An ongoing fishery sampling program may be substituted for this requirement if determined by the NMFS to be appropriate. The fishery sampling program shall be approved by the NMFS. The program design shall be submitted to the NMFS by May 1 and shall include a description of the planned monitoring activities, locations and schedule. If fishery sampling indicates that salmon and/or steelhead are within the TBP project area during operation, the NMFS shall be immediately notified. Notification shall include the date, time, location and apparent condition of the observed salmon and/or steelhead. If appropriate, authorization for incidental take associated with implementation of the fishery sampling program will be provided upon NMFS' approval of the sampling program.

c. An annual report or reports, summarizing the monitoring programs described in a. and b. above along with findings and recommendations for subsequent years programs, shall be provided to the Supervisor, NMFS, Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814, no later than March 1 of the year following barrier operations.

d. If either of the monitoring programs described in a. or b. above indicate that the TBP is adversely affecting listed salmon or steelhead to an extent or in a manner not considered when reviewing the proposed operations the DWR shall amend the operations plan, in coordination with the NMFS, DFG, FWS, and the CVP and SWP operators, to avoid or minimize the direct and/or indirect incidental take of listed salmon or steelhead within the project area or at the CVP and SWP export

pumps near Tracy, as appropriate. The revised operations plan shall be approved by the NMFS prior to initiating installation and operation of the HORB and 3 agricultural barriers during subsequent years.

IX. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. These "conservation recommendations" include discretionary measures that the Bureau can take to minimize or avoid adverse effects of a proposed action on a listed species or critical habitat or regarding the development of information. In addition to the terms and conditions of the Incidental Take Statement, the NMFS provides the following conservation recommendations that would reduce or avoid adverse impacts on listed species:

1. The ACOE and DWR should support expanded anadromous salmonid monitoring programs throughout the Sacramento-San Joaquin Delta, and specifically the south Delta, to improve our understanding of the occurrence, distribution and life history of listed species and improve the ability to provide fisheries protection through real-time management of CVP and SWP facilities.

2. The ACOE and DWR should support and promote aquatic and riparian habitat restoration within the Sacramento-San Joaquin Delta with special emphasis upon the protection and restoration of shaded riverine aquatic habitat.

X. REINITIATION OF CONSULTATION

This concludes formal consultation on the actions outlined in the biological opinion for the proposed VAMP fishery sampling program from April 15, 2000 through June 1, 2011. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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